HIGH—PERFORMANCE HF TRANSCEIVER
YAESU FT-101ZD

GENERAL DESCRIPTION

The FT-101ZD is a precision engineered, high-performance HF transceiver of advanced design, providing all band (160 - 10 meters) operation on SSB, CW, and AM. This transceiver operates at an input power of 180 watts.

Advanced features include digital plus analog frequency display, continuously variable IF bandwidth (300 Hz - 2.4 kHz), a superb noise blanker with threshold adjustment, and an effective RF speech processor. The receiver boasts excellent dynamic range, despite its high sensitivity, for reliable operation in the presence of strong signals.

Built into every FT-101ZD are VOX, semi-break-in CW with sidetone, a 25 kHz crystal calibrator, selectable AGC, and a 10 dB/20 dB RF attenuator in the incoming signal path.

The FT-101ZD has been engineered for use. Controls and switches are laid out in an efficient and logical manner, so you won't have to fumble for a switch or knob when you need it quickly. And Yaesu designers have now made it possible for you to switch sidebands without recalibrating the display.

All circuits, except the transmitter driver and final amplifier stages, are solid state. Solid state devices provide extremely high reliability and high component density, along with low power drain. The FT-101ZD may be operated from a variety of AC voltages, from 100 to 234 volts. A DC-DC converter, providing operation from a 13.5 VDC power source, is an available option.

For the economy FT-101Z, the counter unit is an available option, providing digital display capability should you want to upgrade your transceiver at a later date. Optional equipment on both models FT-101ZD and FT-101Z are the cooling fan, DC-DC converter, 600 Hz CW filter, and microphone.

A diecast front panel, and the heavy-duty case, provide maximum protection for your transceiver. If the ratings of this unit are not exceeded, it will provide the owner with many years of satisfying operation. Please read this manual carefully before commencing operation, in order to derive maximum satisfaction from your new YAESU transceiver.

SPECIFICATIONS

Frequency coverage:

160 m	1.8 - 2.0 MHz
80 m	3.5 - 4.0 MHz
40 m	7.0 - 7.5 MHz
30 m	10.0 - 10.5 MHz
20 m	14.0 - 14.5 MHz
17 m	18.0 - 18.5 MHz
15 m	21.0 - 21.5 MHz
12 m	24.5 - 25.0 MHz
10 m	28.0 - 29.9 MHz

Power requirements:

AC 100/110/117/200/220/234 volts, 50/60 Hz
DC 13.5 volts ± 10%
(DC-DC converter optional)

Power consumption:

AC 85 VA receive
(73 VA HEATER OFF)
330 VA transmit
DC 5.5 amps receive
(1.1 amps HEATER OFF)
21 amps transmit

Size:

345 (W) x 157 (H) x 326 (D) mm

Weight:

Approx. 15 kg.

TRANSMITTER

Emission type:

LSB, USB, CW, AM

Power input:

180 watts DC (SSB, CW)
50 watts DC (AM)

Carrier suppression:

Better than 40 dB

Unwanted sideband suppression:

Better than 40 dB (14 MHz, 1 kHz)

Spurious radiation:

Better than 40 dB down

Transmitter frequency response:

300 - 2700 Hz (–6 dB)

Third order distortion products:

Better than 31 dB down

Transmitter frequency stability:

Less than 300 Hz after 10 minute warmup; less than 100 Hz after 30 minute warmup.

Antenna output impedance:

50 - 75 ohms, unbalanced

Microphone input impedance:

500 - 600 ohms (low impedance)

RECEIVER

Sensitivity:

0.25 μV for S/N 10 dB (SSB, CW)
0.5 μV for S/N 10 dB (AM)

Image rejection:

Better than 60 dB (160 - 12 m)
Better than 50 dB (10 m)

IF rejection:

Better than 70 dB (160, 80, 20 - 10 m)
Better than 60 dB (40 m, 30 m)

Selectivity:

SSB, AM 2.4 kHz at 6 dB down, 4.0 kHz at 60 dB down
CW (with optional CW filter) 600 Hz at 6 dB down, 1.2 kHz at 60 dB down

Bandwidth control:

Continuous from 2.4 kHz to 300 Hz

Audio output impedance:

4 - 16 ohms

Audio output:

3 watts at 10% THD, 4 ohm load

Specifications subject to change without notice.

TUBES AND SEMICONDUCTORS

Vacuum Tubes

12BY7A	1
6146B	2

Transistors

T20A6	2
2SA495	1
2SA496Y	2
2SA564A	3
2SA639	1
2SA733	1
2SA952LB	14
2SB616	1
2SC372Y	15
2SC373	1
2SC380TMY	15
2SC535A	1
2SC732TMGR	1
2SC1000GR	2
2SC1383	1
2SC1583	2
2SC1674	1
2SC1815GR	1
2SC1815Y	6
2SC2407	2
MPSA13	1

Field Effect Transistors

2SK19GR	8
2SK19BL	1
3SK40M	1
3SK51-03	7
3SK73	1
J310	2

Integrated Circuits (IC)

μPA54H	1
μPC7505H	1
μPC78L12	1
μPC14308	1
μPC2002H	1
MC3403P	1
MC14024B	1
MSM9520RS	1
NJM78L05	1
SN76514N	1
SN74LS123N	1
TA7060P	1
TA7063P	1

Germanium Diodes

1N60	11
1S1007 (GB)	12

Silicon Diodes

1S1555	65
10D1	7
10D10	8
V06B	2
1SS53	25

Schottky Barrier Diode

ND487C2-3R (Ring Module)	1

Zener Diodes

WZ061	1
WZ090	2

Varactor Diodes

1S2209	1
1S2236	1
FC63	1

Light Emitting Diodes

GD4-203SRD	9

LED Display

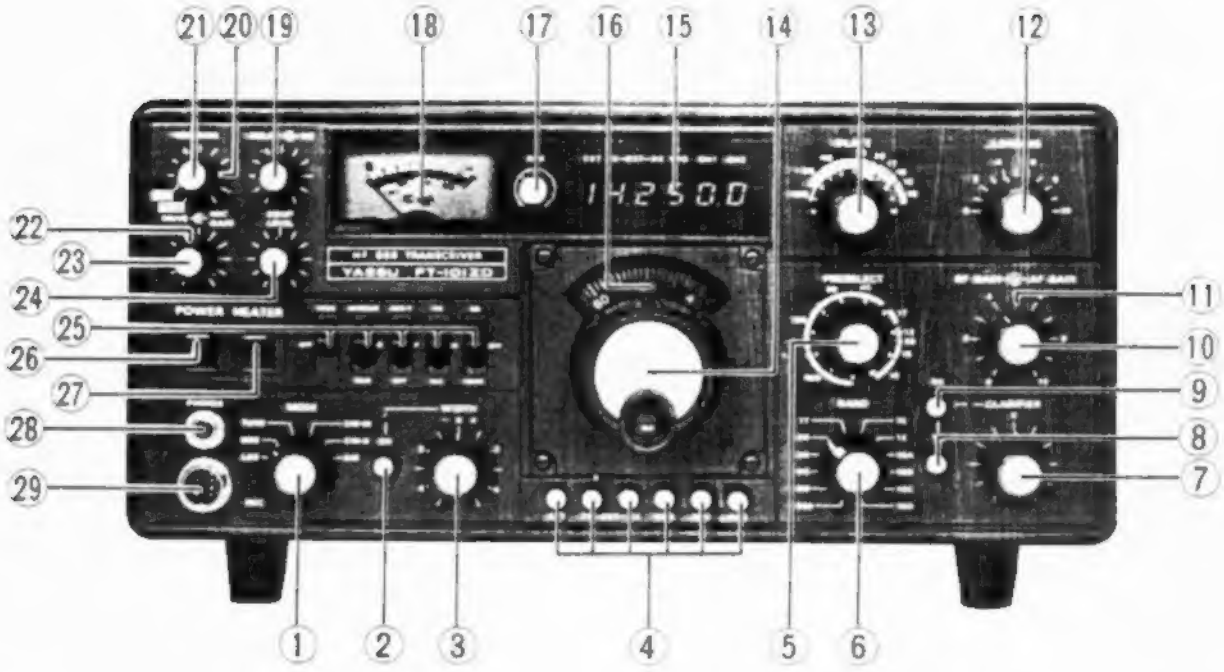
HP-5082-7623	6

FT-101ZD SERIES MODEL CHART

O = BUILT-IN FEATURE X = AVAILABLE OPTION

FEATURE	FT-101ZD	FT-101Z
ALL BAND CRYSTALS	O	O
COUNTER UNIT	O	X
DC-DC CONVERTER	X	X
CW FILTER	X	X
MICROPHONE	X	X
RF PROCESSOR	O	O
COOLING FAN	X	X

CONTROLS AND SWITCHES



(1) MODE

Selection of LSB, USB, CW-W (SSB filter), CW-N (optional CW filter) and AM is provided.

(2) WIDTH ON

When this button is pressed, the variable bandwidth function is activated.

(3) WIDTH

This control varies the IF bandwidth from 2.4 kHz down to 300 Hz. When the WIDTH switch is OFF, the bandwidth is fixed by the filter selected at the MODE switch.

(4) SELECT switches

When using the optional FV-901DM synthesized, scanning external VFO, these switches determine which component will control the transmit, receive, or transceive frequency.

EXT..... This switch, when pressed, shifts control of the transceive frequency to the external VFO.

TX EXT... This switch, when pressed, shifts control of the transmit frequency to the external VFO.

RX EXT... This switch, when pressed, shifts control of the receive frequency to the external VFO.

VFO..... This switch selects control of the transceive frequency on the FT-101ZD internal VFO.

CH1, CH2.. These switches select optional fixed channels, transceive only.

(5) PRESELECT

The preselector control peaks the RF and IF stages for the frequency in use.

(6) BAND

The bandswitch selects the frequency band in use: 160 - 10 meters.

(7) CLARIFIER

The clarifier control allows offset of ±2.5 kHz from the frequency established by the main tuning dial.

(8) (9) CLARIFIER SELECT switches

Press the RX button for offset of the receive frequency.

Press the TX button for offset of the transmit frequency.

Press both buttons for offset of the transceive frequency.

(10) AF GAIN

The AF GAIN control varies the output level of the audio amplifier stages. Clockwise rotation increases the audio output level.

(11) RF GAIN

The RF GAIN control varies the gain of the RF and IF stages. Clockwise rotation increases the gain of these stages.

(12) LOADING

This control tunes the output circuit of the final amplifier pi network to match the feedpoint impedance of the load.

(13) PLATE

This control tunes the plate circuit of the final amplifier.

(14) MAIN TUNING KNOB

Rotation of this knob selects the operating frequency, in conjunction with the setting of the bandswitch. One revolution of the dial produces a frequency change of approximately 17 kHz.

(15) DIGITAL DISPLAY

The digital display reads out the operating frequency, with resolution to 100 Hz. The display unit is built into the FT-101ZD, and is an available option for the FT-101Z.

(16) ANALOG DIAL

The analog dial allows readout of the operating frequency to better than 1 kHz. The combination of the precision dial mechanism and drive unit provides zero backlash at slow tuning rates.

(17) DIM

This control allows dimming of the meter and dial lamps.

(18) METER

The meter displays final amplifier cathode current (IC), relative power output (PO), and ALC feedback voltage.

(19) NB

This control varies the threshold point for the noise blanker, and should be set to the minimum point that provides the desired blanking action.

(20) DELAY

This control sets the delay time for the VOX relay. For voice-actuated SSB, or semi-break-in CW, the operator may select the delay time most suitable for his or her operating habits.

(21) VOX GAIN

The threshold level for the VOX (voice operated relay) system can be varied using this control. In the PTT position, PTT (push to talk) control is provided, for relay control via the microphone PTT switch or footswitch.

(22) DRIVE

This control sets the carrier level for CW/AM and tuning purposes. When the RF processor is ON, this control varies the RF output on SSB, as well.

(23) MIC GAIN

This control sets the output level of the microphone amplifier stage. Clockwise rotation increases the mic gain level.

(24) COMP LEVEL

This control varies the compression level for the built-in RF speech processor. The processor does not function in the AM mode.

(25) FUNCTION switches

PROC ..... This switch activates the RF speech processor.

ATT ..... This switch allows the insertion of 10 or 20 dB attenuators in the incoming signal path.

AGC S/F/OFF .. This switch allows selection of the desired AGC decay time. In the OFF position, the AGC is switched off, and the S-meter will not function.

PO/IC/ALC .... In the PO position, relative power output is displayed on the meter. In the IC position, final amplifier cathode current is displayed. In the ALC position, ALC voltage is displayed. Regardless of the setting of the meter switch, the meter functions as an S-meter on receive.

NB/MARK ..... In the NB position, the noise blanker is activated. In the MARK position, the internal crystal calibrator is activated.

(26) POWER

This is the main ON/OFF switch for the transceiver.

(27) HEATER

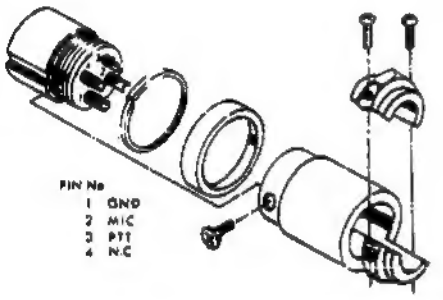
With the HEATER switch on, heater voltage is applied to the driver and final amplifier tubes. This switch may be turned off during periods of RX, when energy conservation is critical.

(28) PHONES

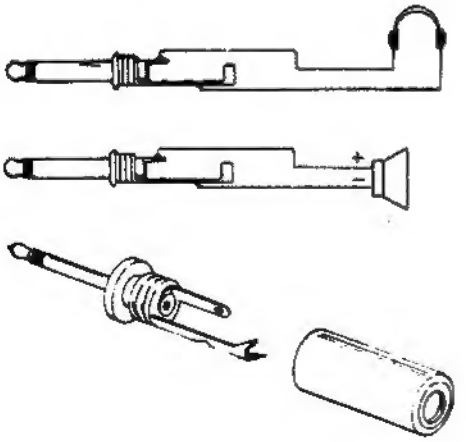
This is a standard ¼" phone jack for use with headphones.

(29) MIC

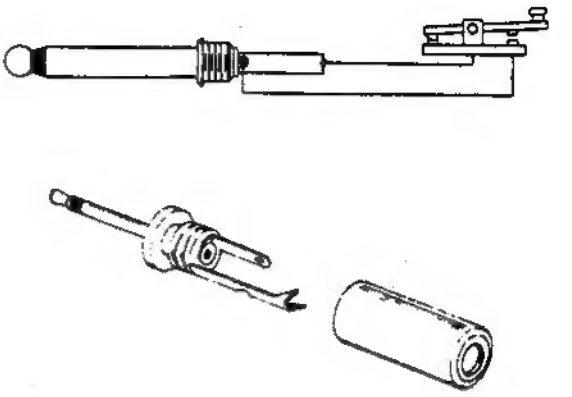
This is a 4 conductor jack for microphone and PTT input.



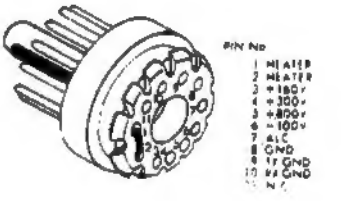
Mic plug



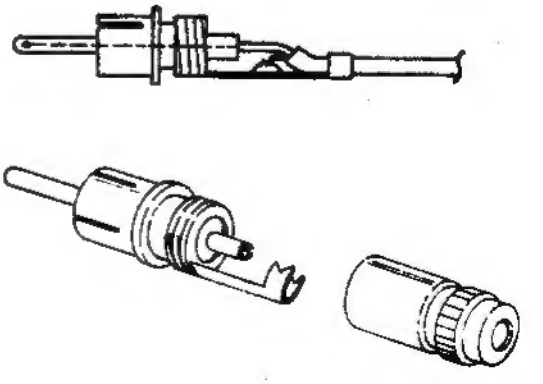
Headphone and external speaker plug



Key plug

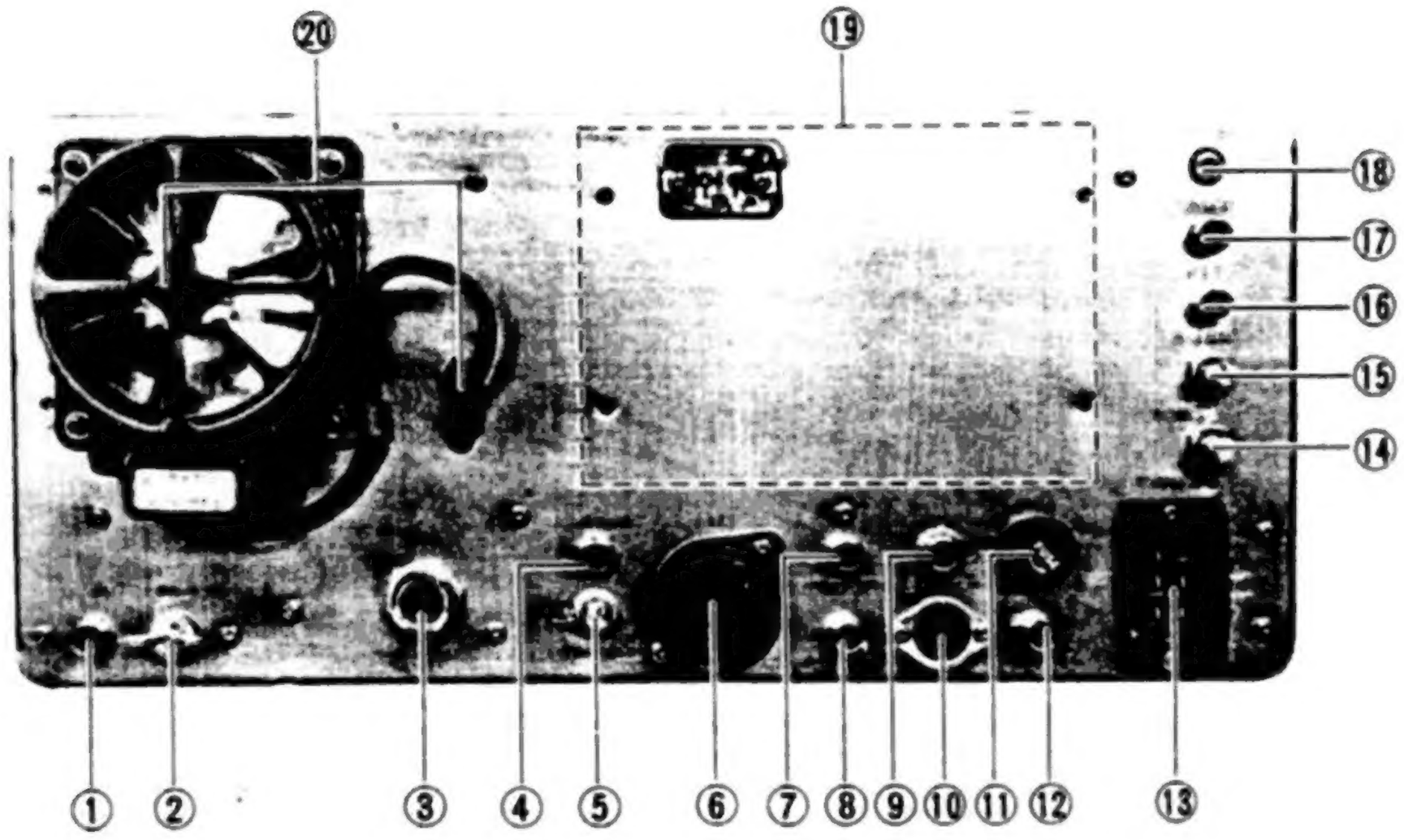


ACC plug



Pin plug

REAR APRON



(1) RF OUT

RF output of 3 volts RMS is available at this jack for use with a transverter. Output is from the driver stage.

(2) GND

For best transceiver performance, as well as protection from electrical shock, a good ground connection should be made at this point, using a heavy, braided wire of the shortest length possible.

(3) ANT

Standard "UHF" connector for the antenna.

(4) RCV ANT

This jack is switched in parallel with the ANT jack on receive, for use with an external receiver.

(5) PO ADJ

This control adjusts the relative power output meter.

(6) ACC

Transceiver operating voltages and relay connections can be accessed through the accessory jack. Please insert the ACC plug at all times, to provide heater voltage for the driver and final amplifier tubes.

(7) TONE OUT

The CW sidetone may be fed to an external receiver through this jack.

(8) A TRIP IN

Anti-trip input from an external receiver may be made via this jack, to prevent the receiver audio output from tripping the FT-101ZD VOX.

(9) KEY

The CW key may be connected at this point. Key-up voltage is 7 volts, and key-down current is 1.5 mA. Be sure your electronic keyer's output switch will handle these levels.

(10) EXT VFO

Connection of an external VFO, such as the FV-101Z or FV-901DM, can be made at this jack.

(11) FUSE

This is the fuse holder. For 100 - 117 volts, replace with only a 5 amp use. For 200 - 234 volts, use a 3 amp fuse. Replace fuses only with a fuse of the proper rating.

(12) IF OUT

Wideband IF output is available at this jack for use with a spectrum analyzer, etc.

(13) POWER

Connect the AC power cord at this point, being certain that your AC supply voltage matches the voltage specification for your transceiver. See the transformer primary connection chart. When using the optional DC-DC converter, the DC supply is connected at this point. DO NOT CONNECT THE AC POWER CORD TO A DC POWER SOURCE. OUR WARRANTY DOES NOT COVER DAMAGE CAUSED BY SUCH IMPROPER POWER CONNECTIONS.

(14) TONE

This control varies the CW sidetone output level.

(15) A TRIP

This control varies the level of the VOX anti-trip circuit.

(16) PTT

External control of the transceiver PTT (push to talk) system may be made at this jack, for use with a footswitch, etc.

(17) PATCH

Microphone or phone patch input may be made at this jack. Impedance is 500 ohms.

(18) EXT SP

This is a miniature phone jack for speaker output. When a plug is inserted into this jack, the transceiver internal speaker will be cut off. Impedance is 4 - 16 ohms.

(19) DC-DC CONVERTER (OPTION)

The optional DC-DC converter allows operation from a 13.5 volt DC power source.

(20) COOLING FAN (OPTION)

The optional cooling fan keeps the tubes at a safe operating temperature, when they are used in a hot environment. The 2 pin fan power jack supplies 100 volts to the fan.

ACCESSORIES

The following accessories are included with your new transceiver:

(1) AC POWER CORD 1

The power cord comes equipped with a 6-prong connector for connection to the AC supply.

(2) ACC PLUG 1

The accessory plug allows access to relay contacts and transceiver operating voltages. The ACC plug must be inserted in the accessory socket for proper operation of the transceiver, whether or not external connections are being made.

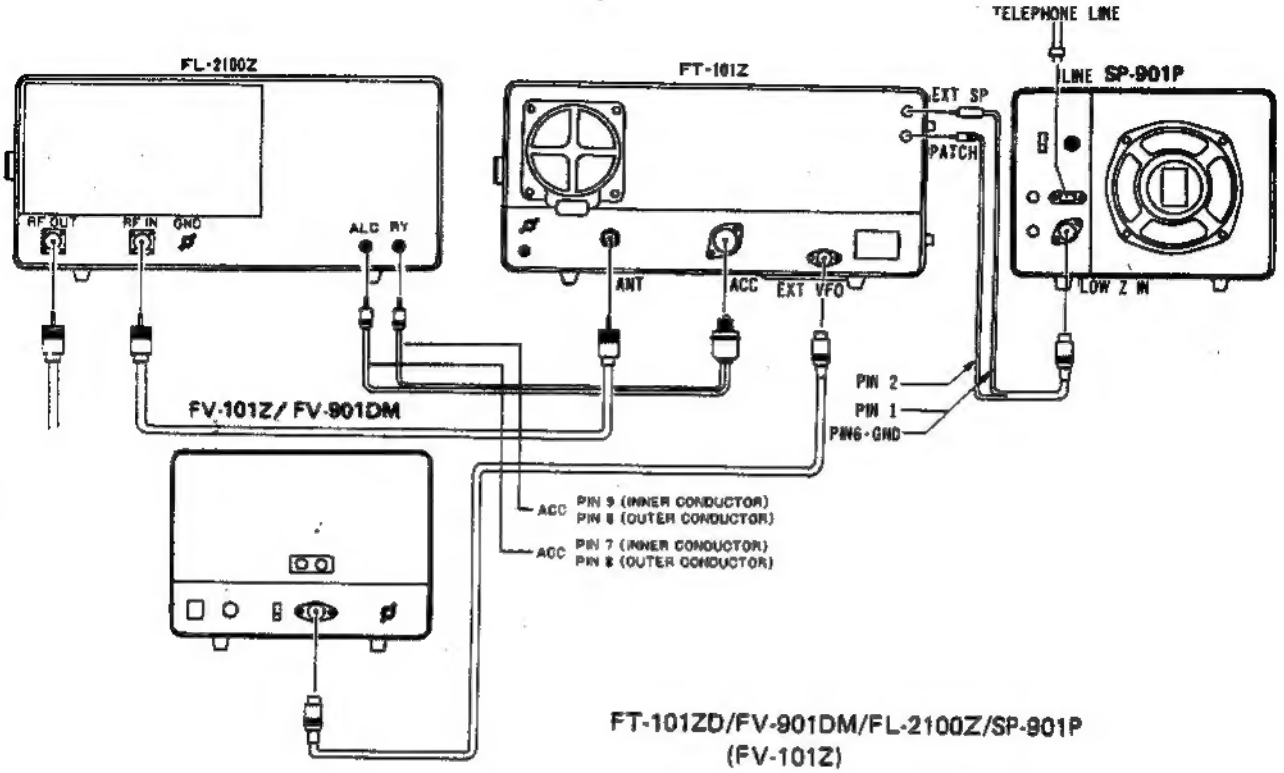
(3) PHONO PLUG 2

Use these plugs for interface with station equipment via the FT-101ZD rear panel.

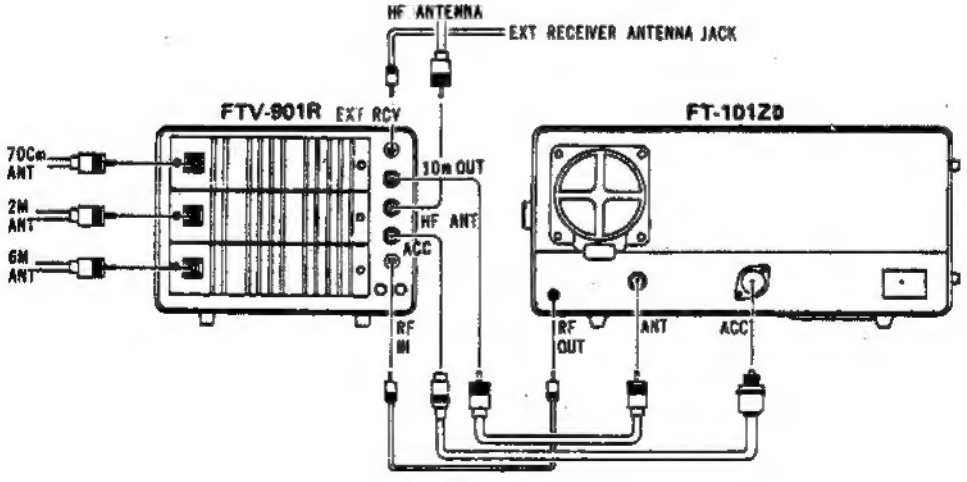
(4) SPARE FUSES 5A (3A) 1 each

When replacing fuses, be absolutely certain to use a fuse of the proper rating. OUR WARRANTY DOES NOT COVER DAMAGE CAUSED BY IMPROPER FUSE REPLACEMENT. For 100 - 117 volt AC operation, use a 5 amp fuse. For 200 - 234 volt operation, use a 3 amp fuse.

INTERCONNECTIONS



FT-101ZD/FV-901DM/FL-2100Z/SP-901P
(FV-101Z)



FT-101ZD/FTV-901R

INSTALLATION

The FT-101ZD is designed to be a single-unit station for fixed or portable operation from AC power. Power supply connections providing for operation from a variety of source voltages are available. Please read the following sections carefully, so as to ensure proper installation of your new transceiver.

PRELIMINARY INSPECTION

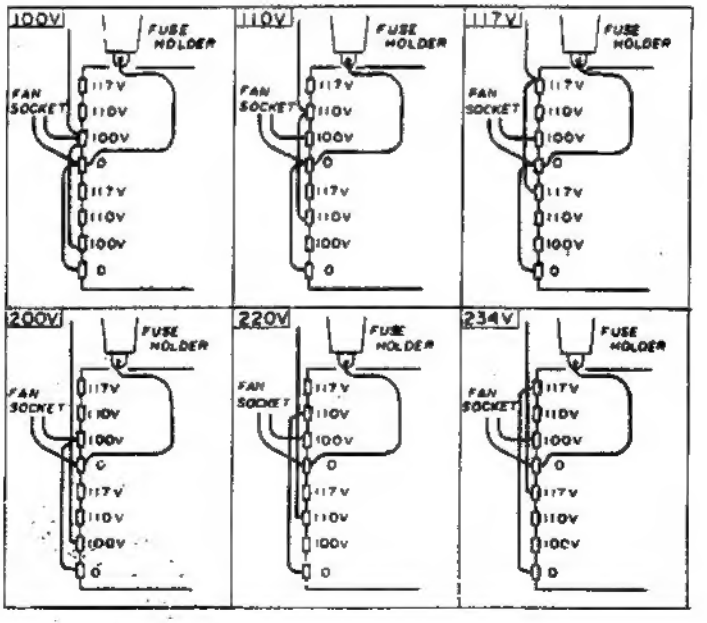
Upon opening the packing carton, immediately give the transceiver a thorough visual inspection. Check to see that all controls and switches are working freely, and inspect the cabinet for any signs of damage. If any damage has been sustained, immediately contact the shipping company, and document the damage completely. Save the packing carton and foam packing material for possible use at a later date.

BASE STATION INSTALLATION

The FT-101ZD is designed for use in many areas of the world, using supply voltages that may differ from your local supply voltage. For this reason, be absolutely certain that the voltage specification marked on the rear of the transceiver agrees with the local AC supply voltage. THIS INSPECTION MUST BE MADE BEFORE CONNECTING THE AC POWER CORD TO THE REAR APRON OF THE TRANSCEIVER.

CAUTION

PERMANENT DAMAGE WILL RESULT IF IMPROPER AC SUPPLY VOLTAGE IS APPLIED TO THE TRANSCEIVER. OUR WARRANTY DOES NOT COVER DAMAGE CAUSED BY APPLICATION OF IMPROPER SUPPLY VOLTAGE. DO NOT CONNECT THE AC POWER CORD TO A DC POWER SOURCE.



The transceiver should be connected to a good earth ground. The ground lead should be made of a heavy, braided wire, and should be connected to the GND terminal on the rear apron of the transceiver.

MOBILE INSTALLATION

(Note: The DC-DC converter described herein is optional equipment. See your Yaesu dealer.)

When the optional DC-DC converter is installed, the FT-101ZD will operate satisfactorily from a 13.5 volt DC power source capable of providing the required current. The DC power cord is included with the DC-DC converter kit.

For under-dash mobile mounting, a special mobile mounting bracket is an available option for your transceiver. The FT-101ZD should be located away from heater ducts, and a minimum of two inches of air space on all sides is recommended, to allow proper air flow around the cabinet. Never stack other units above or below the FT-101ZD, as the accumulated heat from both units could cause damage.

The transceiver requires an average of 14 amps on transmit, with 20 amps on voice peaks. The DC power cable comes equipped with a 20 amp fuse. Be certain to use only a 20 amp fuse when making replacement.

When making battery connections, be absolutely certain that the RED lead is connected to the POSITIVE battery terminal, and the BLACK lead is connected to the NEGATIVE battery terminal. Reversed connections could cause permanent damage to the transceiver. OUR WARRANTY DOES NOT COVER DAMAGE CAUSED BY IMPROPER SUPPLY CONNECTIONS.

It is recommended that the power connections be made directly to the battery, instead of to the ignition switch, etc. The battery provides considerable filtering action against ignition noise, and connection to the ignition switch can place the power line in a noisy circuit. Keep the power lead as short as possible, and keep the lead away from ignition cables.

Before connecting the DC power cable to the transceiver, check the battery voltage with the engine running (battery charging). If the voltage exceeds 15 volts DC, the vehicle voltage regulator should be adjusted, so as to limit the highest charging rate to less than 15 volts. As well, do not operate the transceiver if the DC supply voltage is less than 12 volts. The transceiver should always be turned off when the car is started, to prevent voltage transients from damaging the power supply components.

ANTENNA CONSIDERATIONS

The FT-101ZD is designed for use with an antenna system presenting a 50 - 75 ohm resistive load at the antenna jack. While the transmitter output circuitry is designed for uniform response within this impedance range, significant departures from the 50 - 75 ohm specification will result in seriously degraded transceiver performance, and may result in damage to the final amplifier tubes.

If an open-wire feedline is used, or if the input impedance of the antenna system presents a higher or lower impedance than specified, some sort of antenna tuner must be used to provide the proper impedance for the transceiver. See your Yaesu dealer for details of the FC-902 antenna coupler.

For mobile operation, most of the commercially-available antennas will provide satisfactory results, if care is taken to tune the antenna for minimum SWR. The outer conductor of the coaxial cable should be securely grounded to the automobile chassis at the antenna mount. See your Yaesu dealer for details on the RSL series of mobile antennas.

OPERATION

The tuning procedure for this transceiver is not complicated. However, care should be exercised when tuning so that peak performance of the equipment is secured. The following paragraphs describe the procedure for receiver and transmitter tuning.

INITIAL CHECK

Before connecting the transceiver to the power source, be certain that the voltage specification marked on the rear of the transceiver matches your local supply voltage, and also confirm that a fuse of the proper rating is being used.

FREQUENCY SELECTION

Frequency readout on the FT-101ZD is by digital as well as analog displays. The FT-101Z uses analog display only. The analog readout dial provides resolution to 1 kHz, while the FT-101ZD digital display provides resolution to 100 Hz. The digital display may be added to the FT-101Z as an option. See your Yaesu dealer for details.

RECEIVE OPERATION

(1) Preset the controls and switches as follows:

POWER ..... OFF
METER .... OFF
VFO..... Switch pushed
VOX GAIN .. PTT position
RF GAIN .... Fully clockwise
AF GAIN ... Adjust later for comfortable level
BAND ..... Desired band
MODE ..... Desired mode
PRESELECT . Desired band segment
AGC..... OFF
ATT..... OFF
MARK/NB ... OFF

(2) Turn the power switch to ON. The meter will light up, and the operating frequency will be displayed on the dial window (FT-101ZD). Adjust the AF GAIN control for a comfortable listening level, and adjust the PRESELECT control for maximum receiver noise or signal level. The PRESELECT control may require repeaking as the transceiver is tuned across the band.

(3) The RX CLARIFIER may be utilized if the received signal is drifting. Push the RX button, and rotate the CLARIFIER control for offset of up to 2.5 kHz. A red LED indicator will light up when the clarifier is in use.

(4) When pulse-type noise is encountered, the NB (Noise Blanker) switch should be activated. Advance the noise blanker level control (located on the front panel) to the point which provides the desired blanking. Do not advance the level control beyond the point required to eliminate the noise pulses.

(5) For varying the width of the IF passband, press the WIDTH button, and rotate the WIDTH control. In the IF, two 8-pole crystal filters are used. One filter is fixed, and presents a boundary for the bandwidth. The center frequency is then varied across the passband of the second filter, using a mixing scheme that provides no change of pitch in the received signal.

The result is continuously variable bandwidth, from 2.4 kHz down to approximately 300 Hz. When the WIDTH switch is turned OFF, the second IF filter is instantly aligned with the first filter, returning the receiver to a 2.4 kHz bandwidth.

(6) For extremely strong signals, the ATT (attenuator) switch may be activated, providing 10 dB or 20 dB of attenuation on the incoming signal path, depending on the position of the ATT switch.

TRANSMITTER TUNING

The following tuning procedure must be performed prior to commencing operation on the desired mode. See the paragraphs relating to the specific mode after basic transmitter tune-up has been accomplished.

Be certain that a dummy load or matched antenna is connected to the antenna receptacle on the rear apron of the transceiver. It is possible to damage the final amplifier components of this equipment if this simple precaution is not followed prior to commencing transmission.

Do not exceed 10 seconds of key-down time while tuning.

As well, be certain that the ACC plug is inserted into the rear apron ACC jack. Without this plug, there will be no power applied to the tube heaters. Heater voltage is applied through pins 1 and 2 of the accessory socket.

(1) Preset the controls and switches as follows:
MODE ..... TUNE
DRIVE ..... Fully counterclockwise
DELAY ..... Fully counterclockwise
MIC GAIN..... Fully counterclockwise
COMP LEVEL ... Fully counterclockwise
HEATER ..... ON
PROC ..... OFF
PO/IC/ALC IC
PLATE ..... Set to desired band segment
LOADING 0
PRESELECT ..... Peaked on receive for maximum response
TX CLARIFIER .. OFF (button not pushed)

(2) Turn the HEATER switch ON, and wait 1 minute for the tube heaters to warm up.

(3) Set the VOX GAIN switch to the MOX position. Observe the reading on the IC meter: it should read 50 mA with no drive applied. If it is not, adjust the PB-1968 BIAS control for a resting current of 50 mA on the IC meter. Refer to the BIAS Adjustment on Page 37. Be certain that the DRIVE control is fully counterclockwise for this adjustment.

(4) Set the VOX GAIN switch to MOX. Advance the DRIVE control for a reading of 150 mA.

(5) Peak the PRESELECT control for a maximum meter reading. If the meter reading exceeds 150 mA, reduce the setting of the DRIVE control.

(6) Rotate the PLATE control for a minimum reading ("dip") on the IC meter. Return the transceiver to the receive mode by rotating the VOX GAIN switch out of the MOX position.

LOADING POSITIONS

BAND	FREQUENCY	POSITION
160m	1.8MHz	2.5
	2.0MHz	6.0
80m	3.5MHz	3.0
	4.0MHz	6.0
40m	7.0MHz	6.0
	7.5MHz	6.5
30m	10.0MHz	7.0
	10.5MHz	8.0
20m	14.0MHz	3.0
	14.5MHz	4.0
17m	18.0MHz	2.0
	18.5MHz	2.0
15m	21.0MHz	2.0
	21.5MHz	2.5
12m	24.5MHz	3.0
	25.0MHz	3.0
10m A	28.0MHz	2.0
10m B	28.5MHz	2.0
10m C	29.0MHz	2.0
10m D	29.5MHz	2.0

NOTE: LOADING positions are nominal. Minor variations from positions shown are to be expected.

FINAL TUNING

Final transmitter tuning uses the relative power output setting of the METER switch. At full rated output, using a 50 ohm load, the PO meter will indicate between 1/2 and 2/3 of full scale deflection. If the PO reading is too high (off scale) or too low (1/4 scale or less), and if the load impedance is very close to 50 ohms, the PO ADJ control on the rear apron may be varied to provide the proper deflection. Once the PO meter is calibrated, off-scale deflections are the result of reflected power (high SWR), and corrective action may be required in the antenna system.

Set the controls as follows for final tuning:

(1) Set the METER switch to PO. Rotate the DRIVE control to the 9 o'clock position.

(2) Rotate the VOX GAIN control to the MOX position, and rotate the PRESELECT control for a maximum meter reading.

(3) Rotate the LOADING control for a maximum meter reading. Rotate the PLATE control for a maximum meter reading.

(4) Again rotate the LOADING control and PLATE control, each time advancing the

DRIVE control approximately 2 steps, until the DRIVE control is fully clockwise. The transmitter is now tuned for maximum power output. Do not exceed the maximum tuning time stipulated previously. Return the VOX GAIN switch to the VOX position (out of the MOX position), return the METER switch to IC, and return the DRIVE control to the fully counterclockwise position.

SSB OPERATION

After completing the above tuning procedure, set the MODE switch to USB or LSB as desired. Set the VOX GAIN control to PTT, and activate the transmitter by pushing the microphone PTT switch or the footswitch, if used. With the METER switch set to the ALC position, speak into the microphone in a normal voice. Advance the MIC GAIN control until the meter kicks up to the midscale of the green-colored portion of the meter scale.

Note: When the METER switch is set to IC, voice modulation peaks will indicate 150 - 200 mA. Actual peak current, though, is approximately 2 times the indicated value.

To set the sensitivity of the VOX (voice-operated T/R switching) system, advance the VOX GAIN control slowly while speaking into the microphone. Advance the VOX GAIN control to the point where the speech signal activates the transmitter.

Set the antitrip potentiometer on the rear apron to the minimum point which prevents the speaker output from tripping the VOX. Do not use more VOX gain nor antitrip than is necessary. Adjust the front panel DELAY control for the desired relay recovery time.

RF SPEECH PROCESSOR ADJUSTMENT

The FT-101ZD RF speech processor, when correctly adjusted, will improve the intelligibility threshold at the receiving end, by increasing the average SSB power output. RF clipping is applied to the IF signal, which is then filtered to remove harmonics and out of band intermodulation products. RF envelope clipping causes much less distortion than that caused by an equivalent amount of AF clipping, and the result is an output signal with more "punch".

Set the PROC switch to OFF, and set the MIC GAIN control as described previously (voice peaks falling within the green zone of the ALC meter scale). Now set the PROC switch to ON, and set the COMP LEVEL control to the 10 o'clock position. Advance the DRIVE control so that the desired power output is obtained, and be sure that the ALC meter indication is within the green zone.

With the RF speech processor activated, the ALC meter indication may not be quite as high as when the processor is off. This is entirely normal, because the average power output is higher with the processor, although the peaks are being clipped.

Setting the COMP LEVEL control up to the 3 o'clock position will provide up to 10 dB of compression. Advancing the control beyond the 10 o'clock point may, however, degrade the voice-to-noise ratio, so caution is recommended.

CW OPERATION

After completing the tuning procedure, insert the key line into the KEY jack on the rear panel.

The operator may select any power output desired by advancing the DRIVE control. Once the maximum power output level has been reached, the DRIVE control should not be advanced further.

The transmitter may be activated by the VOX circuit, or by the PTT or MOX systems. The TONE control on the rear apron of the transceiver sets the CW sidetone level.

The key-up voltage at the key jack is 7 volts, and the key-down current is 1.5 mA.

For receiving, two positions of selectivity are provided. When the optional CW filter is installed, the operator may select between the 600 Hz bandwidth of the CW filter and the 2.4 kHz bandwidth of the SSB filter. The WIDTH control may be used with either position of the MODE switch: CW-W or CW-N.

AM OPERATION

AM operation of the transmitter is accomplished by setting the MODE switch to the AM position and inserting the proper amount of carrier with the DRIVE control.

After completing basic transmitter tune-up, place the MODE switch in the AM position. Activate the transmitter, and rotate the DRIVE control until the meter reads .10 (100 mA) in the IC position of the METER switch. While speaking into the microphone in a normal voice, increase the MIC GAIN control until the meter indicates very slight movement with voice peaks. Care must be exercised that the DRIVE control is not advanced too far. Do not exceed .10 (100 mA) meter indication during AM operation or damage to the transmitter final amplifier tubes may result.

SELECT SWITCHES

The SELECT switches allow selection of internal or external VFO frequency control, as well as selection of up to 2 optional crystal-controlled channels.

When the crystal-controlled channels are installed, they may be selected by pressing CH1 or CH2, as desired. See the crystal information elsewhere for full information on crystal requirements.

The external VFO, FV-101Z and FV-901DM, which provide versatile operations with your FT-101ZD, are available from your Yaesu dealer.
Because there is no calibrated dial for the FV--901DM, it can't be used with the analog FT -101Z.

For transceive frequency control on the external VFO, press EXT. For external VFO control of the transmit frequency, with receive frequency control on the FT-101ZD, press TX EXT. For receive frequency control on the external VFO, and transmit frequency control on the FT-101ZD, press RX EXT. For full transceive control on the FT-101ZD, press VFO.

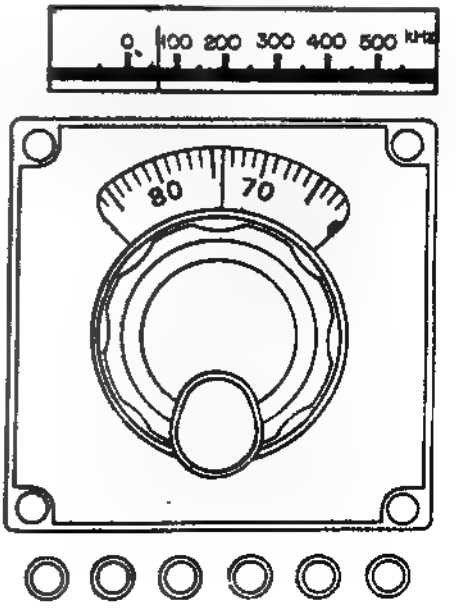
DIAL CALIBRATION AND FREQUENCY DETERMINATION

The FT-101ZD mixing scheme accounts for the difference in carrier frequencies between USB and LSB. For this reason, no recalibration is required. Once the calibration is properly aligned (at the factory, or in shop), no further adjustment is required for accurate frequency derivation. The 25 kHz calibrator is included largely for alignment purposes, as it provides a useful reference signal for signal peaking, etc.

Frequency readout on the FT-101ZD digital display is straightforward. The full operating frequency is displayed, with resolution to 100 Hz.

The analog display on the FT-101Z and FT-101ZD transceivers provides easy determination of the operating frequency. The frequency displayed on the analog sub dial (and the main display window, for the FT-101Z) is added to the lower band edge frequency.

For example, if the analog dial indicates 074, as shown in the example, and the BAND switch is on 40 meters (lower band edge: 7000 kHz), the operating frequency will be 7074 kHz. By rotating the BAND switch, this position of the analog display will produce 14074 kHz for 20 meters, 21074 for 15 meters, etc. For 80 and 12 meters, the lower band edges are 3500 kHz and 24500 kHz, while for 160 meters the band edge is 1.5 MHz. Therefore, the dial should read 074 to produce 3574 kHz, but 374 for 1874 kHz. Be careful so as not to operate outside the amateur bands.



FIXED CHANNEL CRYSTAL INFORMATION

Two fixed channels may be used with your FT-101ZD, using optional crystals. Crystals are available from your Yaesu dealer. Crystals must meet the specifications shown in Table 2 , and must fall within the operating range 5500 - 5000 kHz. Frequency calculation is made from the formula

$$F_X = F_1 - F_0$$

where F_X is the crystal frequency
F_1 is a constant derived from Table 1
F_0 is the operating frequency.

For example, let us say it is desired to operate on 7199 kHz LSB. Referring to Table 1, we see that for 40 meter LSB, F_1 is 12501.5 kHz. Subtracting F_0 (7199 kHz) from F_1 (12501.5 kHz) yields 5302.5 kHz, the crystal frequency (F_X).

For operation on 21420 kHz USB, compute the crystal frequency as follows:
$F_X = 26498.5 - 21420 = 5078.5$ kHz.

Inspection of the values of F_1 in Table 1 will reveal that the 7199 kHz crystal for LSB will work on 14199 kHz, 21199 kHz, etc. Of course, LSB is not normally used on these bands. If the operator switches to USB, the operating frequency will be moved 3 kHz (in this case, to 14196 kHz, 21196 kHz, etc.). If the move is made from LSB to CW, the frequency will move 2.3 kHz down.

MODE / BAND	U S B	L S B	C W
160m	6998.5	7001.5	6999.2
80m	8998.5	9001.5	8999.2
40m	12498.5	12501.5	12499.2
30m	15498.5	15501.5	15499.2
20m	19498.5	19501.5	19499.2
17m	23498.5	23501.5	23499.2
15m	26498.5	26501.5	26499.2
12m	29998.5	30001.5	29999.2
10m A	33498.5	33501.5	33499.2
10m B	33998.5	34001.5	33999.2
10m C	34498.5	34501.5	34499.2
10m D	34998.5	35001.5	34999.2

Table 1

Type	HC-25/U
Load Capacitance	30pF
Series Resistance	25 Ohms or less
Static Capacitance	7pF or less
Drive Level	5mW

Table 2

CW FILTER INSTALLATION (OPTION)

(1) Remove the top cover of the transceiver case, as shown in Fig. 1.

(2) Refer to Fig. 2, and locate the NB-FIX circuit board. Remove its mounting screws, because this board is obstructing the removal of the IF unit.

(3) Remove the 12-pin, 13-pin, and 15-pin plugs from their sockets on the IF unit. Remove the IF unit mounting screws, and remove the IF unit from the transceiver case.

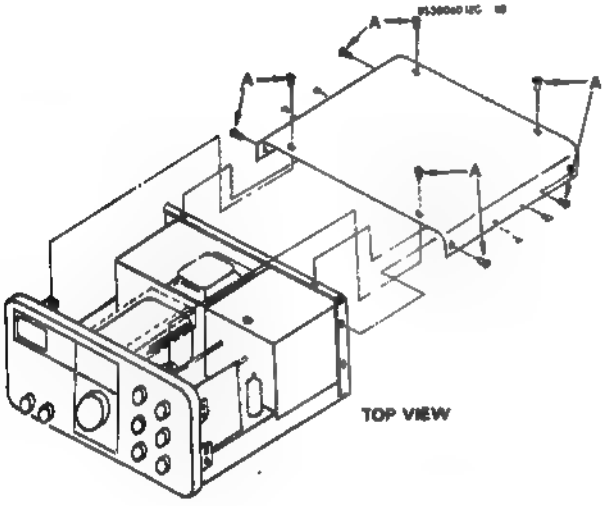


Figure 1

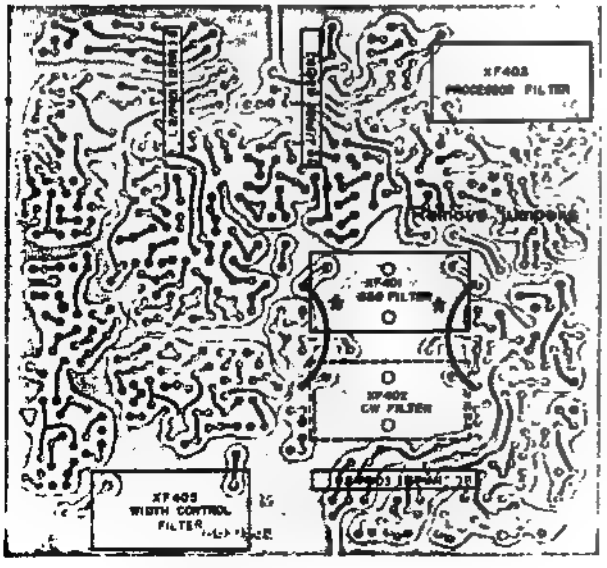


Figure 3

(4) Install the optional CW filter as shown in the foil side view of the IF unit (Fig. 3). Make the fastening nuts snug, and solder the pins of the filter to the circuit board, and remove the 2 jumper wires shown in Figure 3.

(5) Re-install the IF unit, being careful to connect the 12-pin, 13-pin, and 15-pin plugs in the correct sockets. Refer to Fig. 2 to be sure. Re-install the NB-FIX unit, and replace the top cover of the transceiver.

(6) When the optional CW filter is installed, the CW-N position of the mode switch will activate this filter. In the CW-W position, the SSB 2.4 kHz filter will be in use. The WIDTH control is usable in all modes.

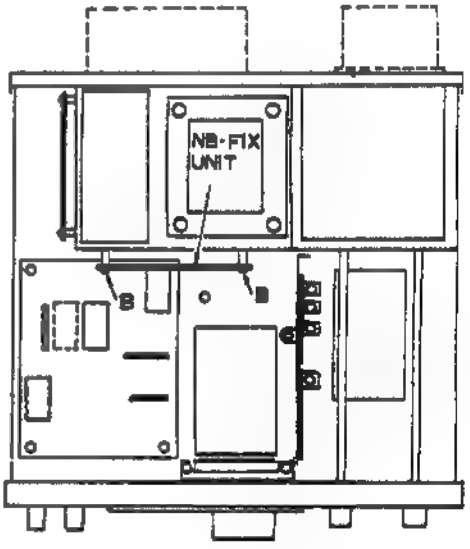


Figure 2

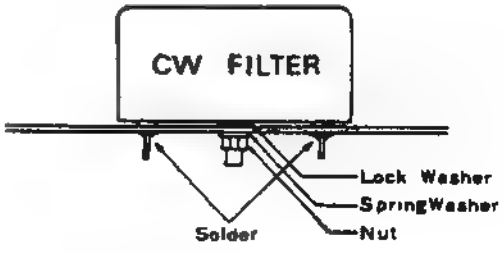


Figure 4

DC-DC CONVERTER INSTALLATION (OPTION)

The optional DC-DC converter is easy to install in a matter of minutes. Please follow the instructions carefully, in order to make the proper connections.

(1) Install the DC-DC converter module as shown in the drawing. Use the four screws supplied with the kit. Do not force the plug into the socket, as the connection should be smooth, yet solid.

(2) Check the DC cable fuse socket, located in the positive (red) lead, to be certain that a 20 amp fuse is installed.

(3) When making connections to the battery, be absolutely certain that the proper polarity is observed. The RED lead should be connected to the POSITIVE (+) battery terminal, and the BLACK lead should be connected to the NEGATIVE (–) terminal. OUR WARRANTY DOES NOT COVER DAMAGE CAUSED BY REVERSED POLARITY CONNECTIONS.

(4) Before connecting the DC power cable to the transceiver, check the automobile voltage regulator level with the engine running (battery charging). The maximum charging rate should be 15 volts or less. If the voltage is higher than this level, please adjust the voltage regulator for a maximum of 15 volts. This precaution applies, as well, to bench power supplies, which should be adjusted in the same fashion. Also, the transceiver should not be operated from a supply voltage of less than 12 volts.

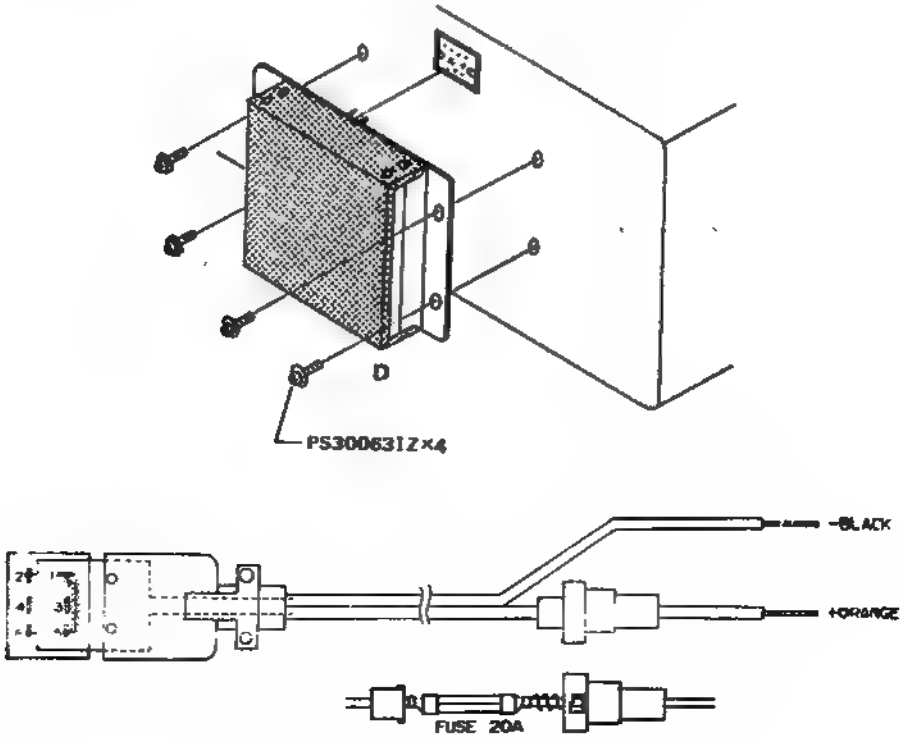
(5) Connect the DC cable to the transceiver. Power connections are made automatically when the DC cable is connected to the POWER jack.

NOTES ON MOBILE INSTALLATION

Be certain that sufficient room is provided for free air circulation around the transceiver. If the transceiver must be placed on the car seat, set it on a board or other rigid object, in order to provide the necessary air circulation (and to avoid possible heat damage to the uphoulstery.

A special mobile mounting bracket is available from your YAESU dealer.

The DC supply should be capable of providing 20 amps on voice peaks, 14 amps continuous. The HEATER switch may be turned off during long periods of reception, for energy conservation.

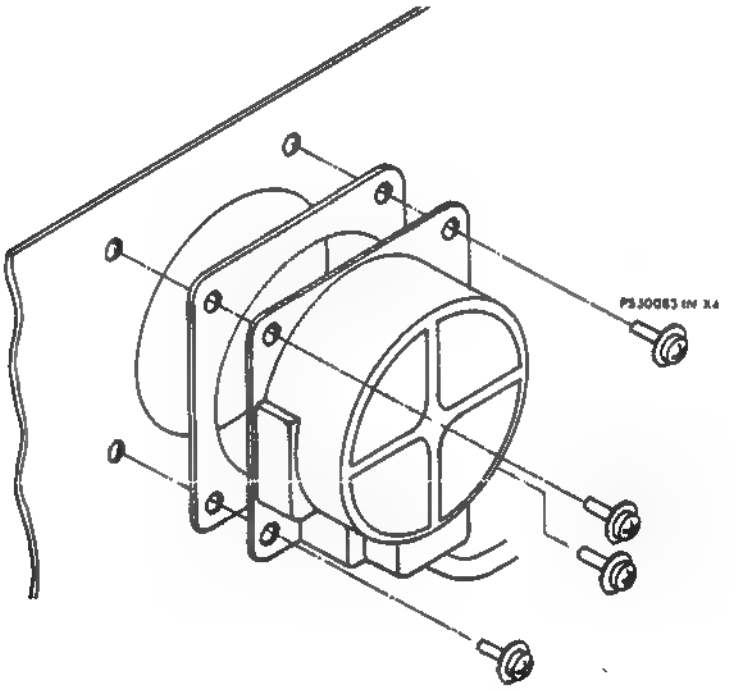


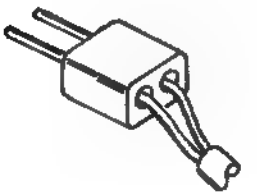
COOLING FAN INSTALLATION (OPTION)

The FT-101ZD cooling fan may be used with other models of Yaesu equipment. Installation is easily accomplished in minutes.

Hold the fan up to the rear panel in its proper location. Determine the proper length of the two-wire power lead to the motor. Solder the leads to the 2-pin plug supplied with the fan. The 4-pin plug is not needed for FT-101ZD installation.

Install the fan onto the rear panel of the transceiver, as shown in the drawing. Insert the power lead from the fan into the fan socket on the rear panel.





Fan plug

COUNTER UNIT INSTALLATION ON FT-101Z

This section will deal with the installation of the COUNTER UNIT and digital display, which are optional equipment for the economy FT-101Z model.

PARTS NEEDED

Optical Filter with double-face tape	(1)
Counter Module	(1)
Guide Pins	(2)
Support Tower	(1)
Vinyl Tubes	(2)

(1) Remove the top cover of the transceiver, according to the drawing on page 17.

(2) Remove the screws marked "A" in Figure 1. These screws support the LED board.

(3) Remove the screws marked "B" in Figure 1, as well as the tension spring, and remove the analog display panel.

(4) Locate the analog display lamp. Cut the leads to this lamp, insert 1 lead each into the vinyl tube supplied with the counter kit, and position these leads out of the way of the VFO gears, etc.

(5) Install the orange optical filter on the inside of the front panel of the transceiver, in the position formerly occupied by the analog display panel. Be sure that it is correctly centered. The filter is held in place by the double-face tape included with the filter.

(6) Install the two guide pins into the holes previously occupied by the "A" screws. When doing this, install the LED board in its previous position. Install the support tower into the hole marked "C" in Figure 1.

(7) Remove the 820 ohm (Gray-Red-Brown) resistor from the terminal strip marked "E" in Figures 1 and 2.

(8) Install the COUNTER UNIT. The connection to the guide pins should not be forced. Use the screws previously installed at "A" for securing the counter module at points "C" (support) and "D" in Figure 1. Connect the COUNTER UNIT 9-pin plug into the 9-pin socket on the transceiver at point "G" in the drawing. The coaxial cable from the COUNTER UNIT is connected to point "F" in Figure 1.

(9) Close the transceiver. No alignment of the unit is necessary, unless some change in the preset carrier frequencies is required for a special application. In this case, refer to the section on the COUNTER UNIT in the "ALIGNMENT" chapter of this manual.

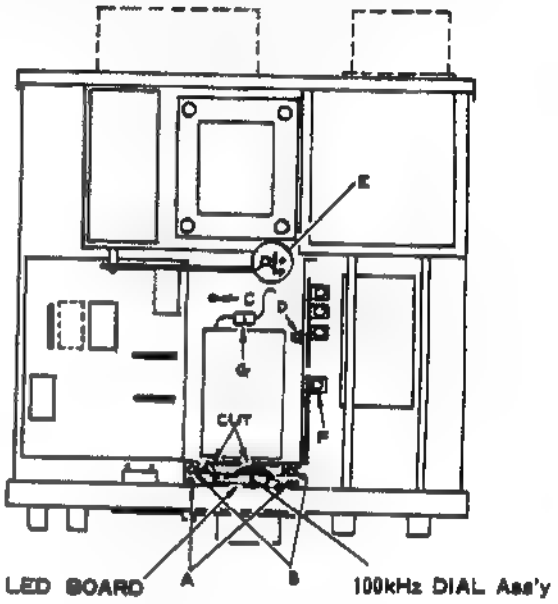
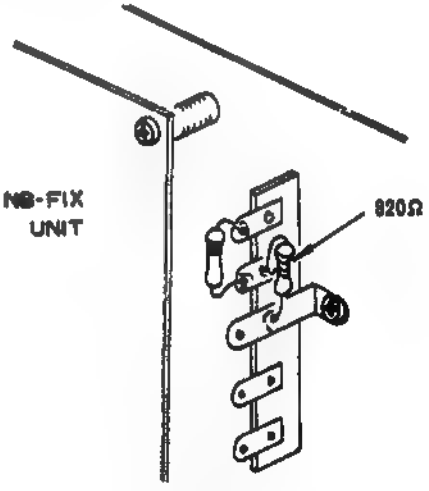


Figure 1



(Enlarged) Part E

Figure 2

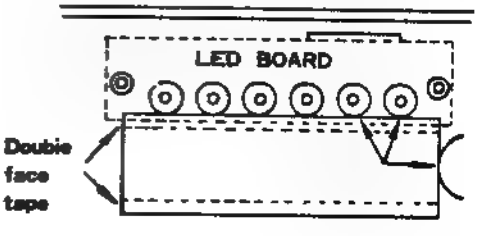
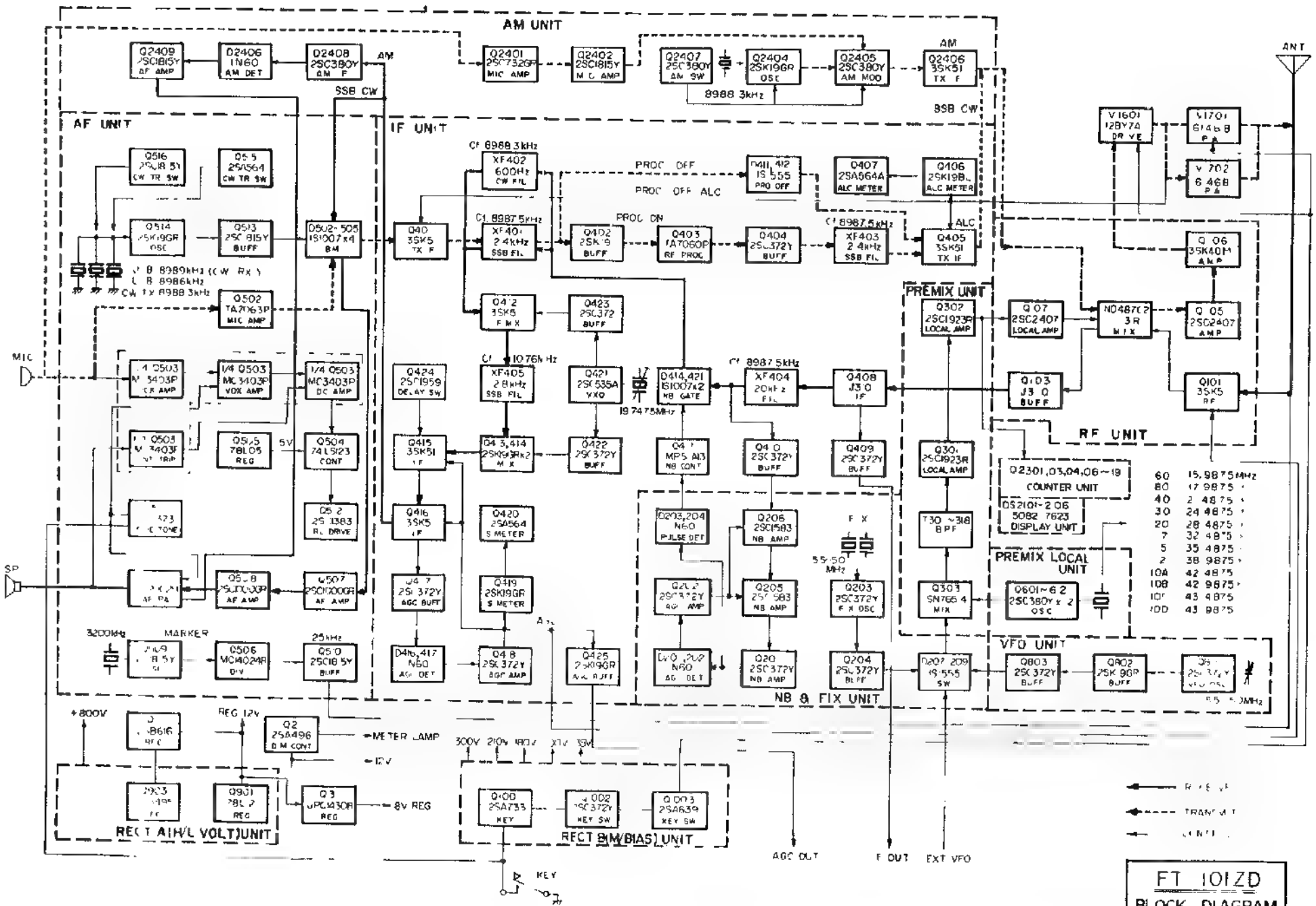


Figure 3


AM UNIT
AF UNIT
IF UNIT
PREMIX UNIT
RF UNIT
PREMIX LOCAL UNIT
VFO UNIT
NB & FIX UNIT
RECT A(H/L VOLT)UNIT
RECT B(M/BIAS)UNIT
ANT
MIC
SP
SSB CW
AM
PROC OFF
PROC ON
PROC OFF ALC
ALC
METER LAMP
+12V
8V REG
REG 12V
+800V
MARKER
KEY
AGC OUT
F OUT
EXT VFO
8988.3kHz
8989kHz (CW RX)
8986kHz
CW TX 8988.3kHz
19.7475MHz
55.50MHz
Q2409 2SC1815Y AF AMP
D2406 1N60 AM DET
D2408 2SC380Y AM F
Q2401 2SC732GR MIC AMP
Q2402 2SC1815Y M.C AMP
Q2407 2SC380Y AM SW
Q2404 2SK19GR OSC
Q2405 2SC380Y AM MOD
Q2406 3SK51 TX F
V1601 12BY7A DRIVE
V1701 6146B PA
V702 6146B PA
Q516 2SC1815Y CW TR SW
Q515 2SA564 CW TR SW
Q514 2SK19GR OSC
Q513 2SC 815Y BUFF
D502~505 1S1007×4 BM
Q502 TA7063P MIC AMP
XF402 600Hz CW FIL
D411,412 1S 555 PRO OFF
Q407 2SA564A ALC METER
Q406 2SK19BL ALC METER
XF401 2.4kHz SSB FIL
Q402 2SK19 BUFF
Q403 TA7060P RF PROC
Q404 2SC372Y BUFF
XF403 2.4kHz SSB FIL
Q405 3SK51 TX IF
Q40 3SK5 TX F
Q412 3SK5 F MIX
Q423 2SC372 BUFF
XF405 2.8kHz SSB FIL
Q421 2SC535A VXO
D414,421 1S1007×2 NB GATE
XF404 20kHz FIL
Q408 J310 IF
Q424 2SC1959 DELAY SW
Q415 3SK51 IF
Q416 3SK5 IF
Q417 2SC372Y AGC BUFF
D416,417 N60 AGC DET
Q418 2SC372Y AGC AMP
Q425 2SK19GR AGC BUFF
Q422 2SC372Y BUFF
Q419 2SK19GR S METER
Q420 2SA564 S METER
Q417 MPS A13 NB CONT
Q410 2SC372Y BUFF
Q409 2SC372Y BUFF
D203,204 N60 PULSE DET
Q206 2SC1583 NB AMP
Q205 2SC1583 NB AMP
Q202 2SC372Y AGC AMP
D210,212 N60 AGC DET
Q20 2SC372Y NB AMP
Q203 2SC372Y F.X OSC
Q204 2SC372Y BUFF
Q207,209 1S555 SW
Q302 2SC1923R LOCAL AMP
Q307 2SC2407 LOCAL AMP
Q305 2SC1923R LOCAL AMP
T301~318 BPF
Q303 SN7614 MIX
Q106 3SK40M AMP
Q105 2SC2407 AMP
Q103 J310 BUFF
Q101 3SK5 RF
Q2301,03,04,06~19 COUNTER UNIT
DS2101~2106 5082 7623 DISPLAY UNIT
Q601~612 2SC380Y×2 OSC
Q803 2SC372Y BUFF
Q802 2SK19GR BUFF
60 15.9875MHz
80 17.9875
40 2.4875
30 24.4875
20 28.4875
7 32.4875
5 35.4875
2 38.9875
10A 42.4875
10B 42.9875
10C 43.4875
10D 43.9875
FT-101ZD
BLOCK DIAGRAM

CIRCUIT DESCRIPTION

The block diagram and following circuit description will provide you with a better understanding of the design of this transceiver. The circuit description is tailored to the full-feature FT-101ZD, and the reader should note that the counter unit and digital display are optional features for the FT-101Z.

The FT-101ZD consists of a premix-type single conversion system, using a 9 MHz IF for all modes of operation.

RECEIVER

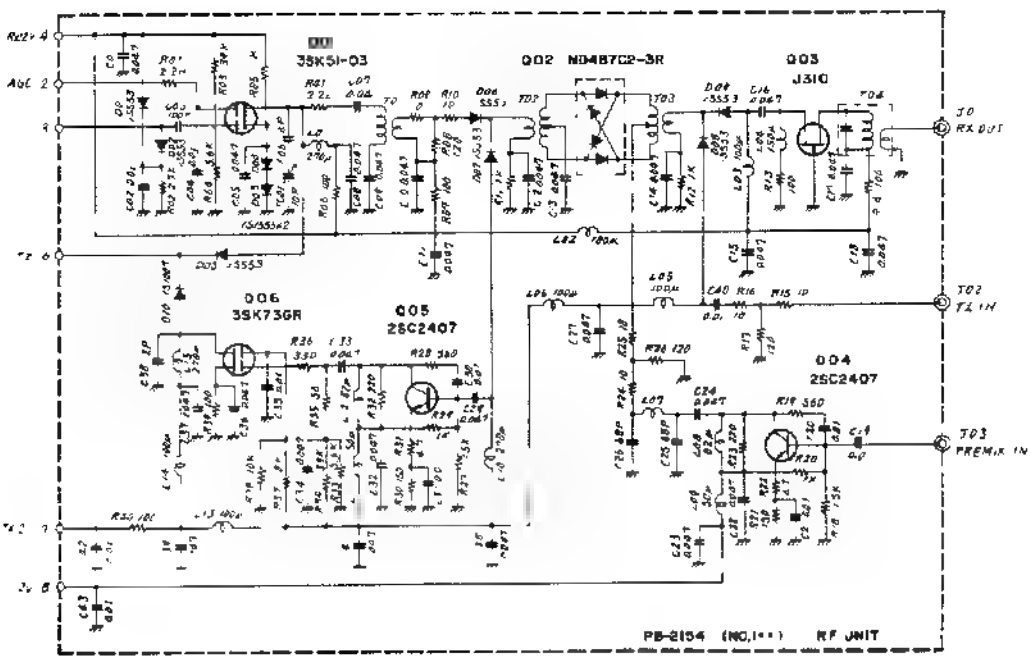
The RF input signal from the antenna is fed through antenna relay RL_2, lamp fuse FH_2, attenuator switch S_{2004} (located on the LEVER SW unit, PB-1975), 9 MHz trap L_{2101} and C_{1207} (located on the TRIMMER A UNIT), and input transformer T_1 to pin 3 of the RF UNIT.

RF UNIT (PB-2154)

The incoming signal is amplified by the RF amplifier, Q_{101} (3SK51-03), a dual gate MOS FET with excellent rejection of cross modulation and intermodulation. The amplified signal is fed to the Schottky barrier diode module, Q_{102} (ND487C2-3R), where the RF signal is mixed with a local signal delivered from Q_{104} (2SC2407), resulting in a first IF of 8.9875 MHz. The IF signal is then amplified by Q_{103} (J310) and fed to J_{101}.

IF UNIT (PB-1963)

The IF signal at pin 9 of J_{403} is amplified by Q_{408} (J310) and passed through a monolithic filter, XF_{404}, which has a ±10 kHz bandwidth. The monolythic filter provides early protection from IMD, while providing a wide-bandwidth point for noise blanking. The IF signal is then fed to noise blanker gate D_{404} (1S1007), which functions as an ON/OFF switch controlled by noise blanker driver Q_{411} (MPSA13).



The IF signal is then passed through the SSB filter XF_{401} (or optional CW filter XF_{402}). Selection of the filter to be used is made by diodes D_{405} - D_{408} (1S1007), depending on the mode of operation.

The IF signal is then fed to the IF first mixer, Q_{412} (3SK51-03), where the incoming signal is heterodyned with a 19.7475 MHz $+\Delta f$ local signal delivered from crystal oscillator Q_{421} (2SC535A) and buffer amplifier Q_{423} (2SC372Y), resulting in a signal of 10.76 MHz $\pm\Delta f$.

The new 10.76 MHz $\pm\Delta f$ signal is fed through filter XF_{405} to the IF second mixer, Q_{413}/Q_{414} (2SK19GR), where the filtered signal is heterodyned with the 19.7475 MHz $+\Delta f$ signal delivered from Q_{422} (2SC372Y), resulting in an 8.9875 MHz IF signal, the same as the original IF.

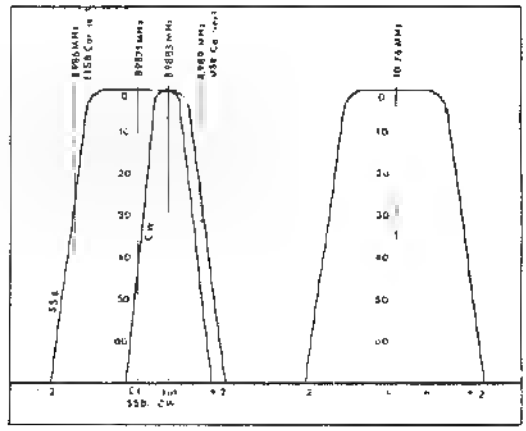
This process varies the IF signal across the passband of the second IF filter. The combination of the two filters, XF_{401} and XF_{405}, provides continuously variable width of the IF passband. The frequency of crystal oscillator Q_{422} is varied by varactor diode D_{418} (1S2209).

The output from the IF second mixer is fed to a two-stage IF amplifier, consisting of Q_{415} and Q_{416} (3SK51-03), and delivered through diode switch D_{401} (1S1555) to the AF UNIT.

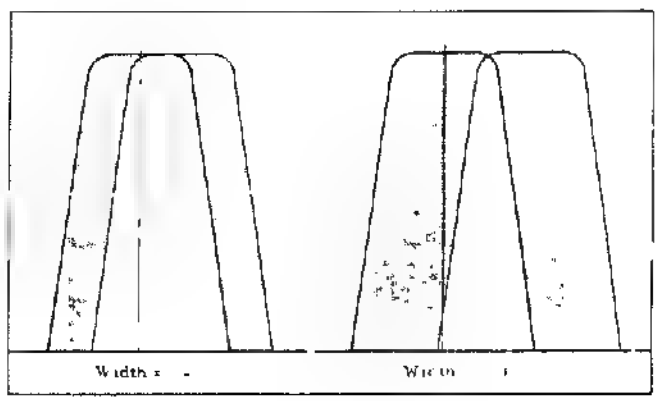
A portion of the output from Q_{416} is rectified by D_{416} and D_{417} (1N60) to produce AGC voltage. Q_{417} (2SC372Y) provides the necessary buffering between the IF and AGC circuits. The AGC voltage is amplified by Q_{418} (2SC372Y), and applied to gate 2 of the RF and IF amplifiers, to control the gain of these stages. The AGC voltage is also amplified by Q_{419} (2SK19GR) for S-meter indication.

For use with the FV-101Z or FV-901DM scanning VFO, or other optional equipment, the AGC voltage is fed through buffer Q_{425} (2SK19GR) and fed to the AGC OUT terminal on the EXT VFO jack, located on the rear panel.

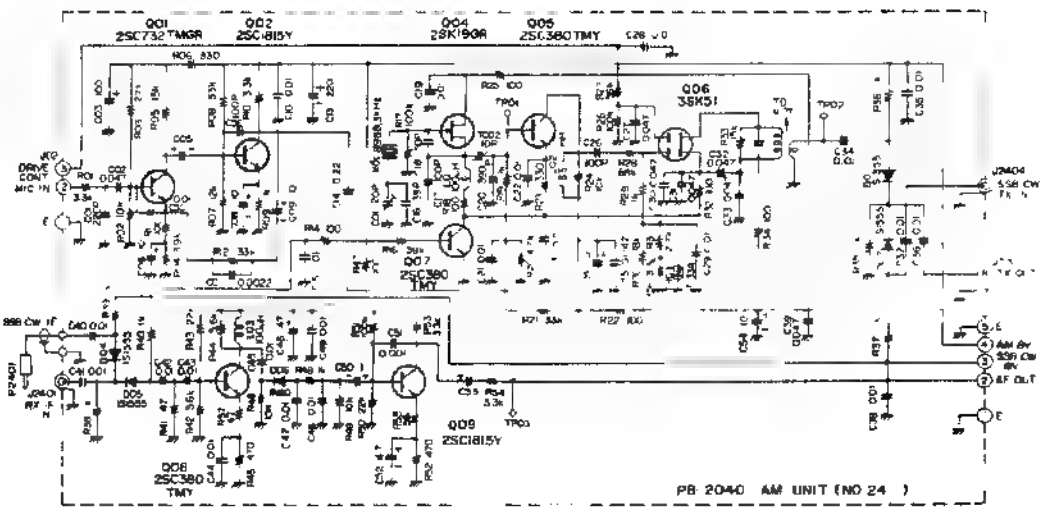
On AM the output signal from Q_{416} is amplified by Q_{2408} (2SC380Y) and passed to the AM detector, D_{2406} (1N60). The resulting audio signal is amplified by Q_{2409} (2SC1815Y) and delivered to the final audio stage.

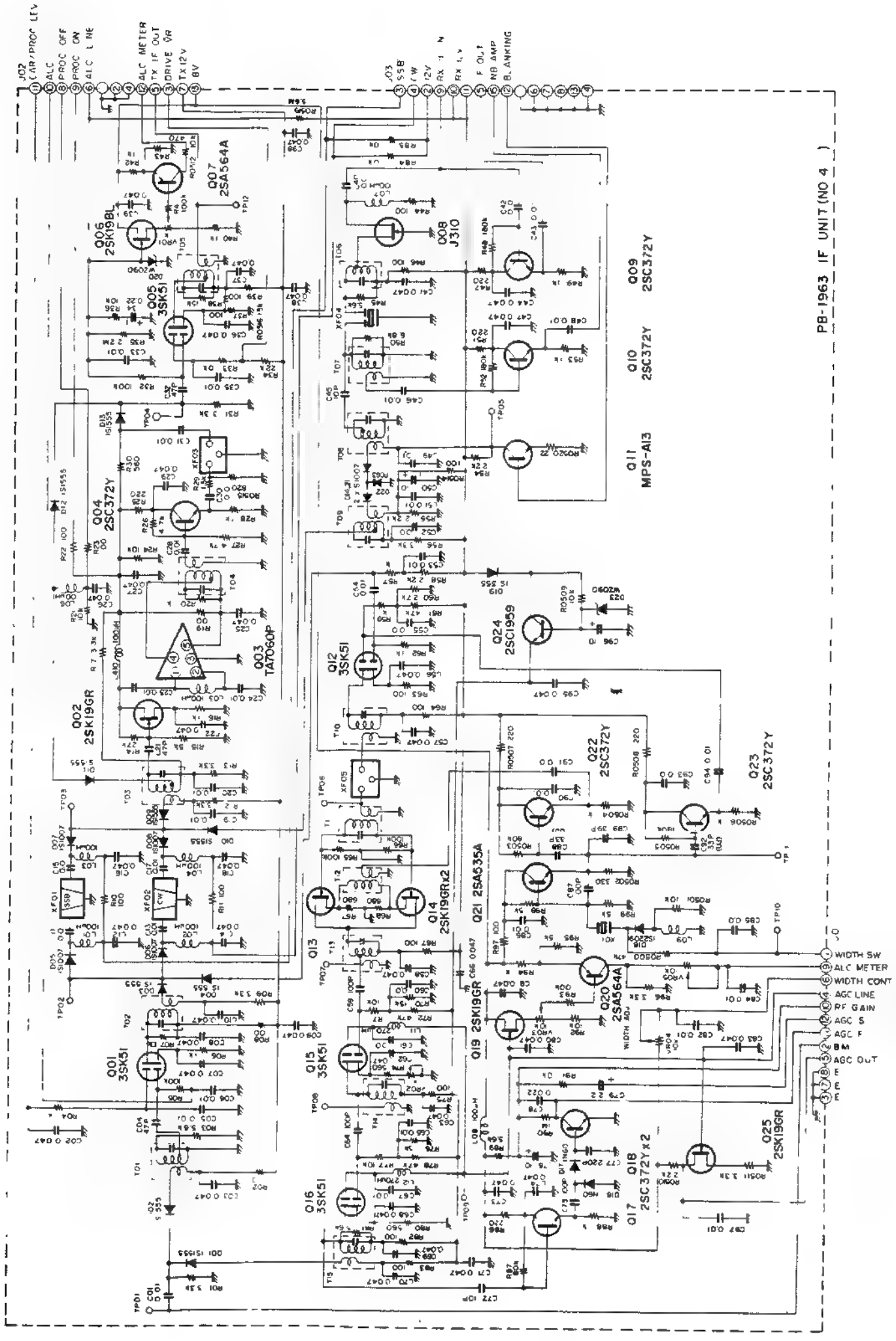


SSB, CW Filters | WIDTH Filter



Width Control Action




PB-1963 IF UNIT (NO 4)
J02
CAR/PROC LEV
ALC
PROC OFF
PROC ON
ALC LINE
ALC METER
TX IF OUT
DRIVE VR
TX 12V
8V
J03
SSB
CW
RX 12V
F OUT
NB AMP
BLANKING
Q01 3SK51
Q02 2SK19GR
Q03 TA7060P
Q04 2SC372Y
Q05 3SK51
Q06 2SK19BL
Q07 2SA564A
Q08 J310
Q09 2SC372Y
Q10 2SC372Y
Q11 MPS-A13
Q12 3SK51
Q13
Q14 2SK19GRx2
Q15 3SK51
Q16 3SK51
Q17 2SC372Yx2
Q18
Q19 2SK19GR
Q20 2SA564A
Q21 2SA535A
Q22 2SC372Y
Q23 2SC372Y
Q24 2SC1959
Q25 2SK19GR
WIDTH SW
ALC METER
WIDTH CONT
AGC LINE
RF GAIN
AGC S
AGC F
BM
AGC OUT

NB-FIX UNIT (PB-1961)

A portion of the 8.9 MHz IF signal is fed through buffer Q_{410} (2SC372Y) and amplified by Q_{206} and Q_{205} (2SC1583).

When a carrier of noise-free modulated signal is received, the IF signal is rectified by D_{201} and D_{202} (1N60), producing a DC voltage. This DC voltage is amplified by Q_{202} (2SC372Y), which charges C_{214}, for AGC purposes. The AGC voltage is used to control the gain of Q_{206} and Q_{205}.

When impulse-type noise is received, D_{203} and D_{204} (1N60) rectify the IF signal, producing a DC voltage which controls the NB switch Q_{411} (2SC372Y).

Noise pulses have a very short duration, but high amplitude. Because of the very slow time constant of the C_{214}/R_{212} discharge path, AGC voltage is not induced by these short-duration pulses. Therefore, Q_{206} and Q_{205} operate at full gain, providing maximum voltage to the base of Q_{411}. When a pulse is received, Q_{411} biases D_{414} to block the signal path momentarily. When a desired signal and a noise pulse are received simultaneously, the blanking action is not impaired, because the relative amplitude difference between the desired signal and the noise pulse is still high. The front panel noise blanker level control varies the DC voltage applied to the base of Q_{411}.

AF UNIT (PB-1964)

The IF signal from pin 2 is fed through T_{501} to the ring demodulator, consisting of D_{502} - D_{505} (1S1007), where the IF signal is demodulated into audio, using the carrier signal delivered from Q_{503} (2SC1815Y). The carrier signal is generated by oscillator Q_{514} (2SK19GR), and it oscillates at one of the following frequencies:

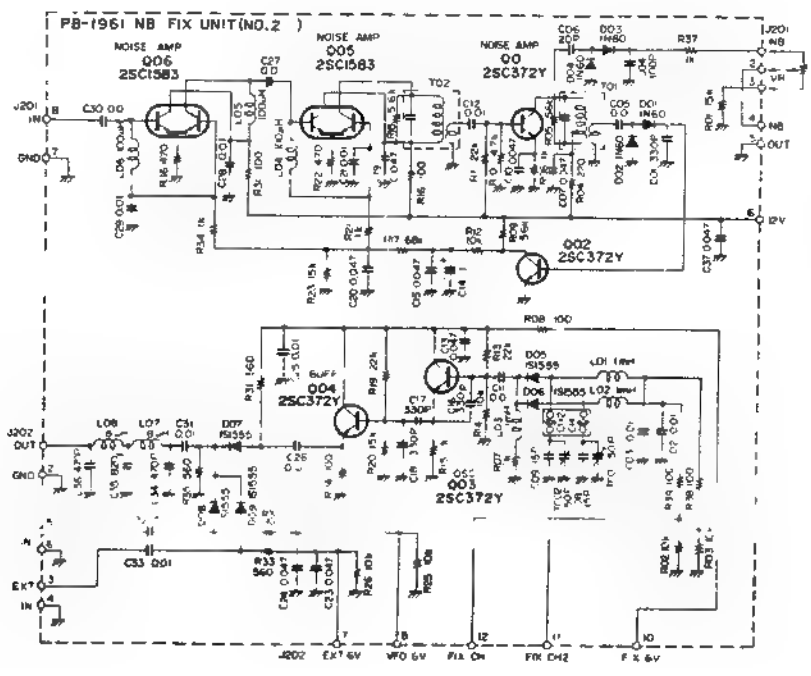
USB, CW-RX	8989 KHz
LSB	8986 KHz
CW-TX	8988.3 KHz

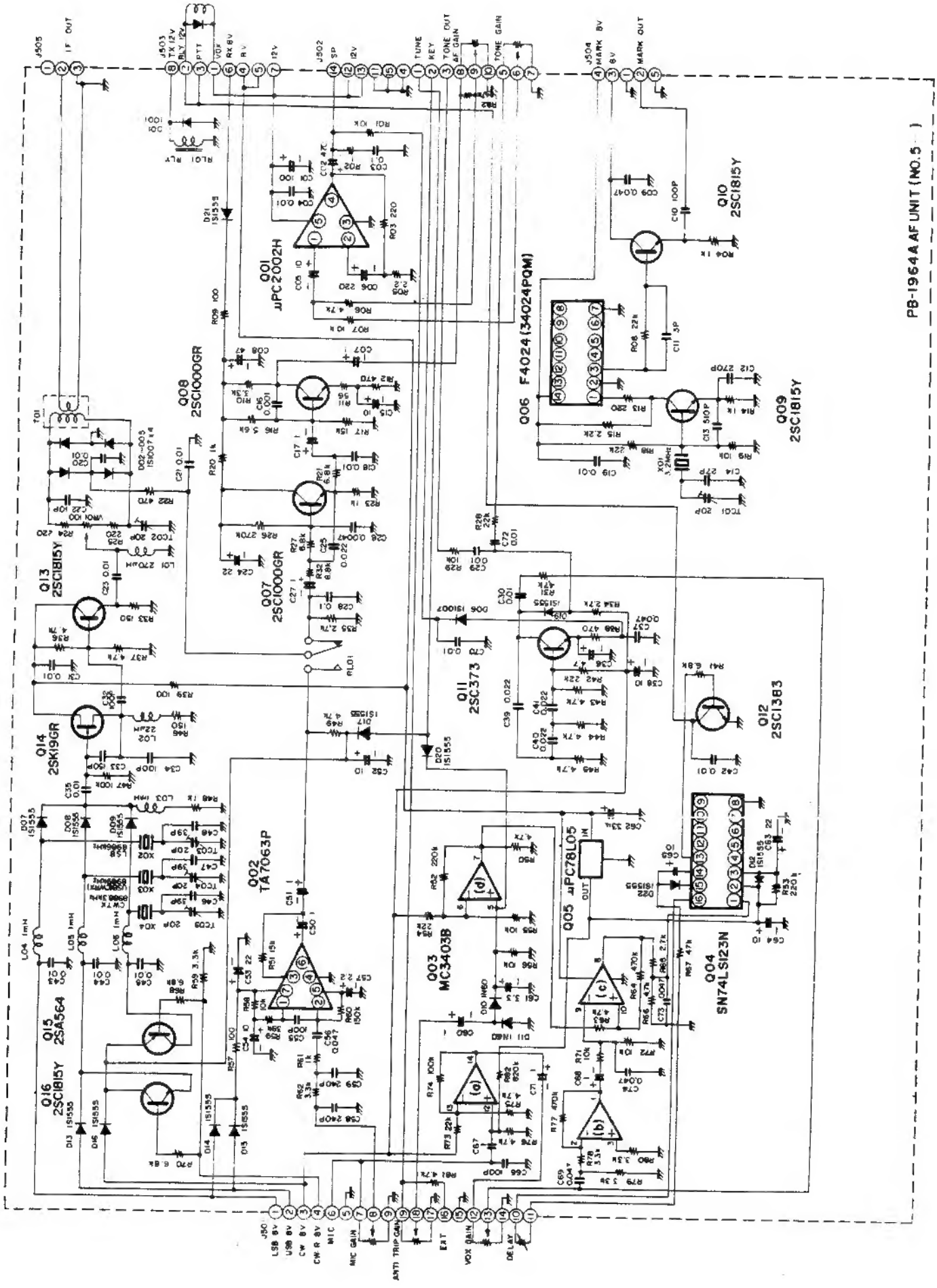
The audio signal is then amplified by audio amplifiers Q_{507}, Q_{508} (2SC1000GR), and Q_{509} (μPC2002), delivering 3 watts of audio output to the speaker.

The audio spectrum is shaped by an active low-pass filter of f_0 = 2.7 kHz, −12 dB/octave.

MARKER GENERATOR

A 25 kHz marker signal is provided, for alignment and testing purposes. Marker generator Q_{509} (2SC1815Y) generates a basic 3200 kHz signal, which is divided into 25 kHz multiples by Q_{506} (MC14024B), a binary counter.




PB-1964A AF UNIT (NO.5)
Q01 μPC2002H
Q02 TA7063P
Q03 MC3403B
Q04 SN74LS123N
Q05 μPC78L05
Q06 F4024 (34024PQM)
Q07 2SC1000GR
Q08 2SC1000GR
Q09 2SC1815Y
Q10 2SC1815Y
Q11 2SC373
Q12 2SC1383
Q13 2SC1815Y
Q14 2SK19GR
Q15 2SA564
Q16 2SC1815Y
J501 LSB 8V
J501 USB 8V
J501 CW 8V
J501 CW R 8V
J501 MIC
J501 MIC GAIN
J501 ANTI TRIP GAIN
J501 EXT
J501 VOX GAIN
J501 DELAY
J502 SP
J502 12V
J502 TUNE
J502 KEY
J502 TONE OUT
J502 AF GAIN
J502 TONE GAIN
J503 TX 12V
J503 RLY 12V
J503 PTT
J503 RX 8V
J503 RX
J503 12V
J504 MARK 8V
J504 8V
J504 MARK OUT
J505 IF OUT

TRANSMIT CIRCUIT

SSB MODE

The output from microphone jack J_2 is fed through the MIC GAIN control VR_{3a} to pin 8 of the AF UNIT.

AF UNIT (PB-1964A)

The speech signal from pin 8 is amplified by microphone amplifier Q_{502} (TA7063P) and fed through relay RL_{501} to the ring modulator, D_{502} - D_{505}, where the speech signal modulates the carrier signal delivered from Q_{513}. The resulting double sideband signal is fed to the IF UNIT.

IF UNIT (PB-1963)

The 8.9875 MHz double sideband signal is amplified by Q_{401} (3SK51-03) and passed through sideband filter XF_{401} by diode switches D_{403}, D_{409} (1S1555), D_{405}, and D_{407} (1S1007). Here the signal is converted to a single sideband signal by removal of the unwanted sideband.

The signal is then fed to buffer amplifier Q_{402} (2SK19GR). When the RF speech processor is OFF, diode switches D_{411} and D_{412} (1S1555) feed the IF signal to IF amplifier Q_{405} (3SK51-03). When the RF speech processor is ON, the SSB signal is amplified by buffer amplifier Q_{402} (2SK19GR) and further amplified by limiter Q_{403} (TA7060P), where signals that exceed the preset clipping level are sliced out.

This highly clipped SSB signal is amplified by buffer amplifier Q_{404} (2SC372Y) and passed through a selective filter, XF_{403}, which removes RF harmonics that result from signal clipping. The signal is then fed to IF amplifier Q_{405}, and subsequently delivered to the RF UNIT. The front panel COMP LEVEL control, VR_4, controls the voltage at gate 2 of Q_{401}, thus setting the processor level.

The return of the grid circuit of the final amplifier tubes is fed to Q_{406} (2SK19BL), which produces ALC voltage. This voltage is fed to gate 1 of Q_{405}, controlling the gain of this stage. When the RF processor is off, ALC voltage is also fed to gate 1 of Q_{401}. Q_{407} (2SA564) amplifies the ALC voltage for indication on the front panel meter.

RF UNIT (PB-2154)

The IF signal from J_{102} is delivered to the Schottky barrier diode module Q_{102} (ND487C2-3R), where the IF signal is mixed with a local signal delivered from Q_{104} (2SC2407), producing the RF output signal. The RF signal is then amplified by Q_{105} (2SC2407) and Q_{106} (3SK40M), and fed through diode switch D_{110} (1S1007) to the DRIVE UNIT.

DRIVE UNIT (PB-1714), PA UNIT (PB-1715)

The RF signal is amplified by driver V_{1601} (12BY7A), and delivered to PA UNIT final amplifier tubes V_{1701} and V_{1702} (6146B). The output from the final tubes is fed to the antenna jack.

A portion of the RF signal is coupled through C_{14} to the cathode of the 12BY7A driver, for the purpose of improving the linearity of the final amplifier. This technique is known as RF negative feedback.

CW MODE

For CW, the 8.9883 MHz carrier is generated by oscillator Q_{514} at the frequency set by X_{504}. The carrier signal is fed through buffer Q_{513} and fed to the ring modulator. The same carrier frequency is used in the tune mode.

DC voltage is applied through diode switch D_{517} (1S1555) and relay RL_{501}, unbalancing the ring modulator for CW operation. The carrier signal is then fed to the IF UNIT. The signal path is identical to that on SSB, up to the DRIVE UNIT.

DRIVE UNIT (PB-1714), PA UNIT (PB-1715)

Keying of the transmitter is accomplished by changing the bias voltage to the driver and final tubes. During "key up," the tubes are cut off by application of −35 volts to V_{1601} and −110 volts to V_{1701} and V_{1702}. These cutoff voltages are

reduced to −0.1 volt and −60 volts, respectively, during "key down" conditions.

The key is connected to the KEY 2 terminal on the RECT B board, PB-1968. When the key is closed, the base of Q_{1001} (2SA733) is grounded, causing Q_{1002} (2SC372Y) to conduct. The base of Q_{1003} (2SA639) is thus set to 0 when the transistor conducts. Under these circumstances, the bias voltage applied to V_{1601}, V_{1701}, and V_{1702} places these tubes in the normal operating condition.

VOX circuit

A portion of the microphone input signal is amplified by three stages of Q_{503} (MC3403P), which drive the VOX control gate, Q_{504} (SN74LS123N). The output from pin 13 of Q_{504} is fed to the base of Q_{512} (2SC1383), switching the VOX relay on and off according to the presence or absence of a speech signal.

A portion of the speaker output is detected by D_{510} and D_{511} (1N60), providing a bucking voltage which is fed to Q_{503}, preventing the speaker output from tripping the VOX.

The VOX delay may be set by adjusting VR_{2b} for the desired delay time.

CW SIDETONE

CW sidetone oscillator Q_{511} (2SC373) oscillates at a frequency of approximately 800 Hz. The output from Q_{511} is amplified by the final audio amplifier, Q_{501}, for delivery to the speaker. The output from the sidetone oscillator is also fed to VOX amplifier Q_{503}, providing semi-break-in operation for CW.

AM MODE

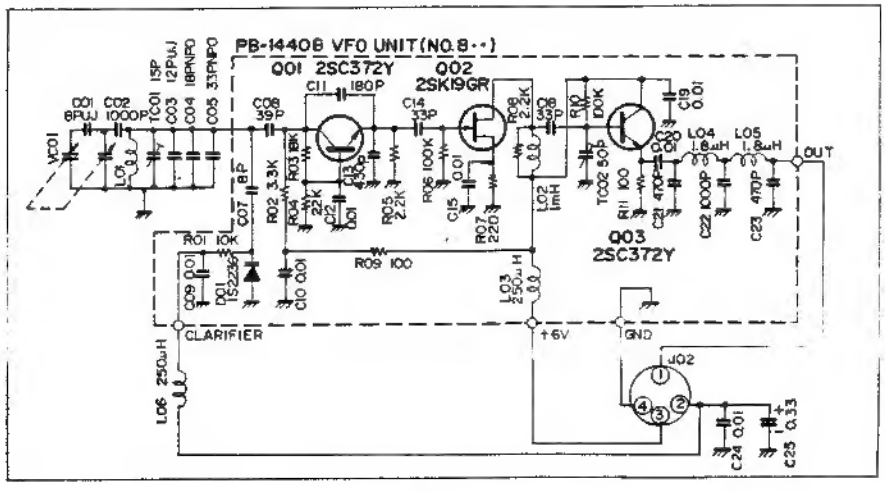
The speech signal from the microphone is amplified by Q_{2401} (2SC732GR) and Q_{2402} (2SC1815Y) and passed to modulator Q_{2405} (2SC380Y), where the speech signal modulates the AM carrier signal at 8988.3 kHz delivered from Q_{2404} (2SK19GR). The modulated signal is amplified by Q_{2406} (3SK51) and delivered to transmit mixer Q_{105}/Q_{106}.

COMMON CIRCUITS

VFO UNIT (PB-1440B-3420)

A modified Colpitts-type oscillator is used to generate a 5.0 - 5.5 MHz VFO signal, thus producing a 500 kHz tuning range. The oscillator signal generated by Q_{801} (2SC372Y) is varied by VC_{801}, which is geared to a precision-built dial tuning mechanism. VC_{801} consists of two sections; the sub-blades compensate for the capacitance variation of the main blades, which may result from extreme temperature change.

Varactor diode D_{801} (1S2209) may be varied by tuning L_{806}, providing ±2.5 kHz offset from the dial frequency (clarifier).



The VFO signal is amplified by buffer amplifiers Q_{802} (2SK19GR) and Q_{803} (2SC372Y), and passed to the PREMIX UNIT.

NB & FIX UNIT (PB-1961)

Two crystal-controlled channels are provided for operation with this transceiver. The oscillator signal is generated by Q_{203} (2SC372Y) and amplified by Q_{204} (2SC372Y), and delivered to the PREMIX UNIT. Crystals X_{201} and X_{202} oscillate in the 5.0 - 5.5 MHz range.

PREMIX LOCAL UNIT (PB-2153)

Crystal oscillators Q_{601}–Q_{612} (2SC380Y) generate the premix local signal at the frequencies shown in Table 3. Diode switches D_{601}–D_{612} (1S1555) select the proper local signal for the band in use. The local signal is then delivered to the PREMIX UNIT.

PREMIX UNIT (PB-2152)

The premix signal is produced at Q_{303} (SN76514N), a double-balanced mixer, where the premix local signal from Q_{601}–Q_{612} is mixed with the VFO or crystal controlled 5 MHz signal. The premix output frequencies are shown in Table 3. The premix signal is passed through bandpass filter T_{301}–T_{304}, and amplified by Q_{301}, Q_{302} (2SC1923R). The amplified signal is then fed to the RF UNIT, where the signal is further amplified by Q_{107} for delivery to the transmitter and receiver mixers.

		XCO Frequency	PREMIX OUT Frequency
160m	X_{601}	15.9875MHz	10.4875~10.9875MHz
80m	X_{602}	17.9875MHz	12.4875~12.9875MHz
40m	X_{603}	21.4875MHz	15.9875~16.4875MHz
30m	X_{604}	24.4875MHz	18.9875~19.4875MHz
20m	X_{605}	28.4875MHz	22.9875~23.4875MHz
17m	X_{606}	32.4875MHz	26.9875~27.4875MHz
15m	X_{607}	35.4875MHz	29.9875~30.4875MHz
12m	X_{608}	38.9875MHz	33.4875~33.9875MHz
10m A	X_{609}	42.4875MHz	36.9875~37.4875MHz
10m B	X_{610}	42.9875MHz	37.4875~37.9875MHz
10m C	X_{611}	43.4875MHz	37.9875~38.4875MHz
10m D	X_{612}	43.9875MHz	38.4875~38.9875MHz

Table 3